8 In this question, the units are metres and seconds.

A particle P is travelling in a straight line through a fixed point O.
At time t its acceleration, a, is given by $a = (2t-3)^2$, where $t \geqslant 0$.

When $t = 3$, P has a velocity of 6.

(a) (i) Find an expression for the velocity, v, of P at time t. [3]

(ii) Find the time when P is at rest. [3]

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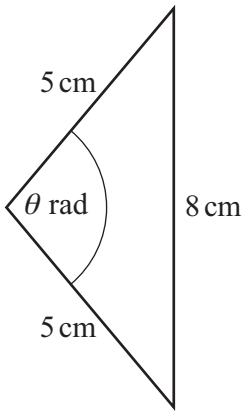
When $t = \frac{5}{2}$, the displacement of P from O is 4.

(iii) Find the displacement of P from O when $t = 3$. [4]

(b) Use calculus to find the approximate change in v when t increases from $\frac{5}{2}$ by the small amount 0.02. [3]

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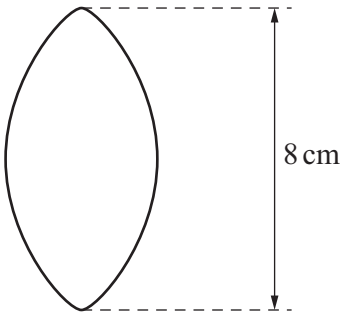
9 **(a)**



The diagram shows an isosceles triangle.

Find the value of θ in radians. [2]

(b)



This diagram shows a shape made of two arcs.
Each arc is part of a circle with radius 5 cm.
The height of the shape is 8 cm.

Use your answer to **part (a)** to find

(i) the perimeter of the shape [2]

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